

of a high order, and “does not admit, as is often the case with heavy masses of astronomical calculations, of being set out for the ordinary computer. Considerable mathematical knowledge, and knowledge of refined methods, and of their adaptability to particular cases, is absolutely essential; and Professor Möller’s success has proved that he possesses this knowledge in an eminent degree.”

Another member of our system which occupied Professor Möller’s attention was the minor planet *Pandora*, the perturbations of which he calculated by Hansen’s method. Many minor investigations appear in the publications of the Lund University, and it is to be remembered that the observatory itself wherein these observations were made is due to Möller. At the time of his appointment as Professor the Lund University only possessed a few very ordinary astronomical instruments; but as a result of his strong and urgent representations the University built a new observatory and equipped it very completely. In this Möller worked zealously for many years, making numerous observations, especially of planets. He was an indefatigable worker. Whatever he undertook he carried through to the end with all his energies. His loss will be severely felt by all who knew him and had felt the influence of his strong and upright character.

[For this notice the Council is indebted to Dr. Folke Engström.]

HUBERT ANSON NEWTON was born on 1830 March 19, at Sherburne, in the central part of New York State, the fifth son of a family of seven sons and four daughters, children of William and Lois Butler Newton. Both parents, who traced back an ancestry to the first settlers of Connecticut, had migrated westwards and settled on a large farm which yet remains in the family. William Newton was a man of considerable enterprise, and undertook the construction of the Buffalo section of the Erie Canal; his wife was famed for her mathematical powers among her near acquaintance, so that the natal gifts to this one of their children are clearly manifest.

Young Newton fitted for college at the schools of Sherburne, giving early promise of mathematical taste. He entered Yale at the early age of sixteen, in the class graduating in 1850. In the college records he appears as a speaker at the junior exhibition of his class, with “India” as his theme, and in the graduation list he won an “oration” stand, though his name is not on the list of commencement speakers. More significant of his gift was the winning of the first prize for the solution of mathematical problems.

After graduation he pursued his studies; was appointed tutor at Yale in 1852, taking full charge of the department of mathematics during the illness of the senior professor at that time; and in 1855 he was elected full professor at the early age of twenty-

five, probably the youngest graduate of the college to reach that honour.

Entering upon this charge after a year's study in Europe, he filled it with signal success until his death, which occurred in New Haven, on 1896 August 12, being then the senior professor as regards length of service in the college. His life was outwardly uneventful, passing away quietly in the duties of his chair, with occasional trips to Europe.

His efforts in the cause of education were shown in many ways, amongst others in the securing of an adequate presentation of the metric system in the school arithmetics of the United States. His contributions to science were in part in pure mathematics, dealing mainly with the analysis of curves; but his name will be chiefly connected with his researches on meteors and comets, a brief enumeration of the most important of which will not be out of place here.

Professor Newton's papers on meteors began to appear in 1860, and dealt at first with a few special cases of observed fireballs; he soon, however, attacked the subject on broader lines. In 1864 he published his well-known discussion of all the original records of the November star shower, finding evidence of thirteen showers since A.D. 902, and showing clearly the existence of the cycle of thirty-three and a quarter years. Considering the phenomenon to be caused by a closed ring of meteoroids revolving around the Sun, he made it clear that the period must have one of five values, ranging from a little less than half a year to the thirty-three and a quarter years of the cycle. He inclined toward one of a little less than one year, but pointed out the test supplied by the variation of the node he had found to amount to 1'7 annually, of which only one half is caused by precession, and the rest must be due to planetary perturbations. As will be remembered, Professor Adams carried out this test, and showed that the long thirty-three and a quarter year period alone gave the correct nodal displacement. The complete verification of Newton's prediction of a large display of meteors on 1866 November 13 is also a familiar matter of history, together with the identification of the orbit of the meteoroids then seen with that of the comet which preceded them about a year.

Meanwhile, in 1865 March, Professor Newton had published a memoir in which from a large number of observations of sporadic meteors he derived their numbers, their frequency in the space traversed by the Earth, their velocity and the conclusion that their orbits resemble those of comets, thus, doubtless, paving the way for the now generally accepted theory of meteors. He also organised parties for the observation of the expected shower, and deduced the relative numbers of shooting stars seen by various numbers of observers.

In 1875, in a paper on the "Origin of Comets," he took up the question as to whether the comets originated from matter in stellar space extraneous to the solar system or formed part of the

primeval solar nebula. Arguing from the distribution of their orbits, he finds that both aphelia and inclinations point to an origin foreign to our solar system. In connection with this he discussed the effect of large planetary perturbations of the planets on the distribution of cometary orbits, a subject he recurred to subsequently in 1891, in a memoir on the "Capture of Comets by Planets, especially *Jupiter*." In this he showed that of 1,000,000,000 comets coming inside *Jupiter's* orbit with parabolic velocity 126, 839, 1,701, and 2,670 will respectively be so retarded by *Jupiter* as to have periods respectively less than $\frac{1}{2}$, 1, $1\frac{1}{2}$, and 2 times that of *Jupiter*.

The Biela meteors of 1885 led him to express his view that these, together with those seen in 1872, must have left the neighbourhood of the parent comet about 1841 or 1842, and in order to account for the rapid disintegration and dispersion, he thought the various particles might have been subject to a varying attraction of the Sun, somewhat in the manner observed in the repellent forces by which the cometary tails are caused.

Professor Newton's last considerable contribution to meteoric science was on the orbits of those meteorites or stones which are in our cabinets, and which were seen to fall. From 265 observed falls, of which 210 only gave the hour and 116 gave the direction also, he found that all but 7 of the 116 moved in orbits having direct motion, and their perihelion distances in general were less than the Earth's radius. At the time of his death he was engaged in editing a collection of a large number of meteor-orbit determinations, mainly observed in America; and it is hoped that this work may be brought out before long.

These investigations, together with numerous smaller ones, did not fail to command the attention and respect of his fellow-scientists, and received both at home and abroad deserved recognition. Professor Newton was one of the original members appointed by Congress to constitute the National Academy of Sciences; was vice-president of the mathematical section of the American Association for the Advancement of Science in 1875, when his retiring address took the form of a strong plea for more study of mathematics by men of science; and president of the Association in 1885, when his presidential address was a synopsis of meteoric lore up to that date. In 1872 he was elected an Associate of the Royal Astronomical Society, in 1886 an Honorary Fellow of the Royal Society of Edinburgh, and in 1892 a Foreign Member of the Royal Society of London.

Professor Newton was deeply interested in the welfare and development of his *alma mater*, and had great influence in the councils of the college and university. The Yale Observatory, when organised in 1882, was placed under his direction, and although he nominally resigned the directorship in 1884, the institution remained under his charge, and may be said to owe its existence to his untiring efforts and personal sacrifices in its behalf.

In personality Professor Newton was most gracious and kindly, and in all things simplicity itself. He was tireless in his efforts to aid poor students at Yale in securing an education, and not a few have owed to him the means of their college careers. He also found time from his numerous duties to devote to the political service of his co-citizens, and served as alderman in the New Haven City council.

Professor Newton married in 1859 Anna C., daughter of the Rev. Joseph C. Stiles, of Georgia. She survived him but three months, leaving two daughters.

FRANÇOIS-FÉLIX TISSERAND est né à Nuits-Saint-Georges, dans le département de la Côte-d'Or, le 13 janvier 1845. Après de bonnes études littéraires il entra, en 1863, à l'Ecole normale supérieure. Le directeur se plaisait, dans les comptes rendus annuels des travaux de l'école, à signaler l'élève Tisserand à ses camarades comme leur donnant tous les bons exemples : à un talent qu'on pressentait Tisserand alliait une modestie rare et le sentiment du devoir.

Sur l'offre de Le Verrier, Tisserand entra, en 1866, comme astronome adjoint à l'Observatoire de Paris. Il fit successivement partie du service méridien, du service géodésique, dont Villarceau était chef, et de celui des équatoriaux. Une thèse consacrée à l'exposition, d'après les principes de Jacobi, de la méthode suivie par Delaunay dans sa théorie du mouvement de la Lune marqua brillamment les débuts scientifiques de Tisserand, qui, peu après, partait en compagnie de MM. Stephan et Rayet pour aller observer sur les rivages de la presqu'île de Malacca la fameuse éclipse de Soleil du 18 août 1868.

Tisserand n'avait que 28 ans quand il fut envoyé à Toulouse pour y réorganiser l'observatoire. Il s'acquitta de cette tâche avec une rare distinction. Les ressources étaient modestes et le personnel faisait défaut. Tisserand devina la vocation astronomique de MM. Perrotin et Bigourdan, qu'il sut s'attacher. Il institua des observations aussi importantes que variées sur les satellites de *Jupiter* et de *Saturne*, les étoiles filantes, les tâches du Soleil ; plusieurs petites planètes furent découvertes.

En 1878 Tisserand recueille la succession de Le Verrier à l'Académie des Sciences ; la même année il entre au Bureau des Longitudes et est appelé à suppléer Liouville à la Sorbonne. A partir de 1883, il occupe la chaire de Mécanique Céleste, d'abord comme suppléant, puis comme successeur de V. Puiseux. Ses obligations de professeur ne l'empêchèrent pas d'aller observer, en 1882, à la Martinique, avec MM. Bigourdan et Puiseux, le passage de *Vénus* sur de Soleil ; le même phénomène l'avait amené, en 1874, au Japon, avec M. Janssen.

C'est à partir de 1883 que Tisserand prit vraiment possession de lui-même. Le devoir, qui s'accordait avec son goût, de parcourir le cycle entier de la mécanique céleste allait le pousser à l'exécution d'un grand ouvrage, Le *Traité de Mécanique Céleste*,